

## DICAST® Continuous-Cable Fiber Optic Chemical Sensors

# Chemical Agent Detection System Covers More Ground and Sounds the Alarm Sooner



## Technology and Innovation

Until recently, complete-coverage chemical detection systems for large facilities were expensive and not very effective. Point sensors detect chemicals in the immediate vicinity, so many sensors are required to cover a large area, and gaps in coverage may delay alarms until the chemical plume reaches a sensor. Standoff detectors can cover a wide area, but they require a clear line of sight to recognize dangers.

Intelligent Optical Systems, Inc. (IOS) has developed a chemical detection system that can provide highly effective coverage of very large areas and perimeters at a much lower cost than other systems.

DICAST® (Distributed Intrinsic Chemical Agent Sensing and Transmission) is a linear chemical detector. The product is based on fiber optic cables that sense specific chemical agents along their entire length through stable, highly-sensitive reagents integrated into the fiber's plastic coating. DICAST detects both toxic industrial compounds and military chemical warfare agents, such as chlorine, hydrogen cyanide and sarin. When detection is needed for new chemicals, IOS engineers individual fibers that are highly sensitive to the new agent(s). The cables, which are passive, can be laid out for hundreds of feet, curving around corners to provide seamless sensor coverage. DICAST's cables can do the work of dozens of point detectors.



DICAST's sensing components respond to the presence of a toxic chemical in seconds, and the alarm moves along the fiber at the speed of light. The system can be set up as one long path or numerous individual sites and monitored from a secure facility far from the actual sensing location.

Since DICAST units can be placed in a central location, fewer of them are needed to completely cover an area.

DICAST is the product of multiple SBIRs. Early development was funded by the National Aeronautics and Space Administration (NASA) to detect moisture and pH. Under DARPA, IOS demonstrated that the optical fibers could be made sensitive to chemical substances of interest to the military and can be used in both alarm-style and position-resolved systems, which can chart the concentration of the target chemical every 10 centimeters. IOS is currently involved in a post-Phase III,

DICAST senses the presence of chemical or toxic agents anywhere along the cable's length.



large-scale, multi-year project—sponsored by the Pentagon's Technical Support Working Group (TSWG)—to develop deployable DICAST systems for toxic industrial compounds and military chemicals.

Military and homeland security applications include perimeter protection against chemical warfare agents. Other applications include monitoring of industrial fencelines; security for heating, ventilation, and air conditioning systems; decontamination verification in areas previously contaminated; and pipeline leak detection.

## Joint Collaborations

Intelligent Optical Systems worked with many private companies and three federal agencies (NASA, DARPA, and TSWG) to develop DICAST. To meet Phase III goals, IOS subcontracted work to 10 companies, two universities, and one government laboratory, located in 11 U.S. states and one Canadian province.

## Lessons Learned

- Use the SBIR projects as a springboard to larger research funds and programs.
- Terminate contracts to underperforming contractors quickly, and don't assign critical path tasks to organizations not designed to meet tight schedules.
- Get to know the people within DARPA. They can provide key insight into the technology that the DoD needs.

## Economic Impact

DARPA funding allowed IOS to demonstrate that DICAST—originally conceived as a corrosion detection system—could be used to detect chemical of military concern. The successful demonstration has opened up new markets and helped attract additional funding (including the \$15 million TSWG contract) that has led to the deployment of two beta-test systems and products.

DARPA and other SBIR funding has been crucial in driving IOS's growth. Almost all of the company's technology has sprung from SBIR projects.

IOS has secured DICAST-related subcontracts from two very large American companies, and discussions of possible applications and alliances continue with commercial and government organizations. The company holds 22 patents (two for DICAST) with 16 more pending (four for DICAST). OpTech Ventures, LLC (Optech) was recently formed to market and commercialize IOS's technologies through subsidiaries, joint ventures and the formation of new companies.

## About the Company

Located in Torrance, CA, a suburb of Los Angeles, IOS was created in 1998 as a spinoff of Physical Optics, Inc. IOS's mission is to become a leading research and development organization in optical sensing and analytical instrumentation. ■

## Company Information

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